



Published in final edited form as:

J Racial Ethn Health Disparities. 2017 April ; 4(2): 213–222. doi:10.1007/s40615-016-0220-5.

Socioeconomic Factors at the Intersection of Race and Ethnicity Influencing Health Risks for People with Disabilities

Elizabeth A. Courtney-Long¹, Sebastian D. Romano^{2,4}, Dianna D. Carroll^{1,3}, and Michael H. Fox¹

¹Division of Human Development and Disability, National Center on Birth Defects and Developmental Disabilities, Centers for Disease Control and Prevention, 4770 Buford Hwy, Mailstop E-88, Atlanta, GA 30341-3717, USA

²Oak Ridge Institute for Science and Education Fellowship with the National Center on Birth Defects and Developmental Disabilities, Atlanta, GA, USA

³Commissioned Corps, U.S. Public Health Service, Atlanta, GA, USA

Abstract

Objectives—People with disabilities are known to experience disparities in behavioral health risk factors including smoking and obesity. What is unknown is how disability, race/ethnicity, and socioeconomic status combine to affect prevalence of these health behaviors. We assessed the association between race/ethnicity, socio-economic factors (income and education), and disability on two behavioral health risk factors.

Methods—Data from the 2007–2010 Behavioral Risk Factor Surveillance System were used to determine prevalence of cigarette smoking and obesity by disability status, further stratified by race and ethnicity as well as income and education. Logistic regression was used to determine associations of income and education with the two behavioral health risk factors, stratified by race and ethnicity.

Results—Prevalence of disability by race and ethnicity ranged from 10.1 % of Asian adults to 31.0 % of American Indian/ Alaska Native (AIAN) adults. Smoking prevalence increased with decreasing levels of income and education for most racial and ethnic groups, with over half of white (52.4 %) and AIAN adults (59.3 %) with less than a high school education reporting current smoking. Education was inversely associated with obesity among white, black, and Hispanic adults with a disability.

Conclusion—Smoking and obesity varied by race and ethnicity and socioeconomic factors (income and education) among people with disabilities. Our findings suggest that disparities experienced by adults with disabilities may be compounded by disparities associated with race,

Correspondence to: Elizabeth A. Courtney-Long.

⁴Present address: Center for Surveillance, Epidemiology and Laboratory Services, Centers for Disease Control and Prevention, 1600 Clifton Rd, NE MS E-97, Atlanta, GA 30333, USA

Compliance with Ethical Standards

Disclaimer The contents of this article are solely the responsibility of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Conflict of Interest The authors declare that they have no conflict of interest.

ethnicity, and socioeconomic factors. This knowledge may help programs in formulating health promotion strategies targeting people at increased risk for smoking and obesity, inclusive of those with disabilities.

Keywords

Disability; Race and ethnicity; Disparities; Cigarette smoking; Obesity

Introduction

Health disparities are differences in health status, behavior, or outcomes experienced by certain groups within a population due to systematically experiencing greater obstacles to health [12]. Race/ethnicity and socioeconomic status (SES) are two indicators typically used in disparity studies in the USA [13, 34]; additionally, there is a growing body of evidence documenting health disparities by disability status [3–5, 25]. According to the International Classification of Functioning, Disability and Health (ICF), disability is a limitation that takes into account medical diagnoses, activity limitations, and barriers to participation [24]. Disabilities can be sensory (e.g., a person who is deaf), cognitive (e.g., a person with an intellectual disability), or related to mobility (e.g., a person who uses a wheelchair) [24, 27, 40]. Depending on the definition used, there are between 36 and 57 million people with disabilities in the US civilian non-institutionalized population [8, 11], with annual disability-associated health care expenditures in the USA estimated at nearly \$400 billion (26.7 % of health care expenditures) in 2006 [2].

Among the general population, racial and ethnic disparities have also been identified in a number of areas [7, 21, 47]. For example, American Indians and Alaska Natives have the highest prevalence of tobacco use, while non-Hispanic whites have the lowest [16]. Among American urban preschool children, there are greater odds of obesity for Hispanics compared to their white counterparts [47], with similar disparities seen in the adult population [14]. Compounding these disparities, racial and ethnic minorities have been shown to experience limited access to health care which could further exacerbate health issues [46]. There are also racial and ethnic differences by disability status. White men have been found to be least likely to have a disability, while black and Hispanic women were most likely [45]. Other studies have found that non-Hispanic blacks and Mexican-Americans were significantly more likely to report a disability than were non-Hispanic white men and women [35], while African American women were significantly more likely to have a disability compared to white women [31].

Indicators of SES, including income and education, have also been identified as important predictors of population health [6, 48]. Blue-collar occupations, low education levels, and low income have all been associated with a higher prevalence of smoking [7, 17]. Low SES has also been associated with an increase in obesity [9]. Analyses of national data have shown that there is an inverse relationship between socioeconomic status (SES) and mortality and that the magnitude of this association may have increased in recent years [1, 37]. An increased use of preventive services, including vaccinations, has been noted among those with higher household incomes [18]. Further, SES is also associated with disability.

Educational attainment has been found to be inversely associated with the onset of functional limitations and chronic conditions [27]. In a global study using data from the World Health Survey, conducted by the World Health Organization, 43 out of 49 countries examined had significant differences in disability prevalence across SES quintiles [28]. In addition, it has been suggested that racial disparities in income and education may account for much of the difference in disability prevalence [44], highlighted by one study that found when controlling for SES in models assessing the association between race and disability, prior significant findings for race and ethnicity were no longer seen [36].

While there is clear evidence that disparities in smoking and obesity are experienced by people with disabilities, as well as by those in certain racial and ethnic groups and SES strata [3, 5, 7, 9, 14, 16, 29, 46], it is unknown whether similar patterns of disparities exist by race/ethnicity and SES among persons with disabilities. Understanding how health disparities are experienced by people with disabilities is a necessary step in working to improve health equity [4]. This knowledge could serve to inform health promotion efforts for the 36 to 57 million Americans with disabilities [8, 11]. Therefore, our study objectives are (1) to estimate the prevalence of disability across racial and ethnic groups by SES and other demographic characteristics; (2) to estimate the prevalence of two behavioral health risk factors, smoking and obesity, among adults with disabilities by SES for each racial/ethnic group; and (3) to assess the associations between SES and smoking and obesity by race/ethnicity, among adults with disabilities.

Methods

Data Source

We used data from the 2007–2010 Behavioral Risk Factor Surveillance System (BRFSS), a state-based random digit dialed telephone-based survey administered by all 50 states, the District of Columbia, and three territories with cooperation from the Centers for Disease Control and Prevention (CDC) [10]. The survey collects data on demographics, health risks and behaviors, and health status among adults 18 years or older. The total numbers of respondents participating each year were as follows: 451,075 (2010), 432,607 (2009), 414,509 (2008), and 430,912 (2007), for a total of 1,729,103 respondents completing the survey over the 4-year period. Overall, 473,351 respondents (27.6 %, unweighted) reported a disability. We aggregated the 4 years of data in order to have a sufficient sample size for some of the smaller race and ethnicity groups among adults with a disability, dividing the weight by four to adjust for the multiple years of data.

Disability Definition

Disability is defined by a “yes” answer to either of the following two questions: “Are you limited in any way in any activities because of physical, mental, or emotional problems?” and “Do you now have any health problem that requires you to use special equipment, such as a cane, a wheelchair, a special bed, or a special telephone?” Respondents who answered “no” to both questions were considered not to have a disability ($n = 1, 221,019$). All other respondents ($n = 19,509$) were excluded from analytic consideration. Although additional variables identifying adults with disabilities have been added to the BRFSS beginning with

the 2013 survey, these two questions were the primary source of disability identification during the analytic years.

Sociodemographic Variables

Race/ethnicity was defined as white/non-Hispanic (hereafter referred to as white), black/non-Hispanic (hereafter referred to as black), Hispanic, Asian, Native Hawaiian or Pacific Islander (NHPI), and American Indian or Alaska Native (AIAN). Hispanic respondents could be of any race. We included specific race/ethnicity categories in which the respondent reported a single race or ethnicity. Therefore, respondents whose race or ethnicity was identified as “other” or “multiple” were not reported (2.9 % of adults with disabilities). Socioeconomic status is often defined as a person’s education, income, and occupation [15]. Since we only had information on a person’s employment status and not occupation, we did not report employment status, but did control for it in the models. We used self-reported family income and education level as measures of a respondent’s SES. Income was defined as annual household income totaling <\$20,000, \$20,000–\$34,999, \$35,000–\$49,999, \$50,000–\$74,999, and \$75,000. Education level was defined as less than high school, high school graduate or a general education development (GED), some college, and college graduate. Employment was defined as employed/unemployed, retired, a student or a homemaker, or being unable to work. Age was categorized into three groups (18–44 years of age, 45–64 years of age, and 65 years of age or greater).

Health Risks and Behaviors

We used two behavioral health risk factors (smoking and obesity) known to have a higher prevalence among adults with a disability [3, 25]. Current smoking was defined as having smoked at least 100 cigarettes in one’s lifetime and currently smoking every day or some days. Obesity was defined as a body mass index (weight (kg)/height (m²)) of 30 or greater, calculated from self-reported height and weight.

Statistical Analysis

We used SAS-callable SUDAAN 11.0 (Research Triangle Institute, Research Triangle Park, NC) in order to account for the complex survey design of the BRFSS. We obtained prevalence estimates of disability by race and ethnicity, and then further stratified by gender, age, income, education, and employment. Prevalence estimates of smoking and obesity among adults with a disability were stratified by race and ethnicity and then stratified further by income and education. Estimates were weighted and age adjusted to the 2000 US standard population (18). Logistic regression models were stratified by race/ethnicity to calculate adjusted odds ratios for the association between income and education and each health risk factor. All models controlled for age, gender, income, employment, and education.

Results

Disability

Overall, 21.0 % of US adults reported a disability. Among adults with disabilities, over half were female (52.8%), and most were white (73.0%). Over 40% were between 45 and 64 years of age. In addition, 27.7% were current smokers and 37.1% were obese (Table 1).

The prevalence of disability varied by race/ethnicity, ranging from 10.1 % (Asian) to 31.0 % (AIAN), and patterns by demographic characteristics within each racial/ ethnic group were generally consistent. A higher percentage of women than men reported a disability (21.7 vs. 20.2 %) and in each racial/ethnic group, except Asian. A pattern of increasing disability by age was evident across all racial/ethnic groups (overall 13.0 % among 18–44 year olds, 26.2 % among 45–64 year olds, and 36.7 % among those 65 years or older). Those with less than a high school education had a higher prevalence of disability (27.1 %) compared to other levels of education, but this varied by racial/ethnic group. For all racial/ethnic groups, disability was highest in the lowest income group (\$20,000; 35.1 % overall). In addition, 81.7 % of adults who were unable to work reported a disability (Table 2).

Smoking

The prevalence of smoking among adults with a disability was 27.7 %, ranging from 12.8 % (Asian) to 41.2 % (AIAN) adults. Overall, adults with disabilities in the lowest income category (<\$20,000) had the highest prevalence of smoking (38.8 %); with the highest prevalence among white and AIAN adults (45.0 and 47.3 %, respectively). AIAN adults had the highest prevalence of smoking (23.7 %) whereas Asian adults had the lowest (5.4 %) in the highest income group (\$75,000). Over half of white and AIAN adults with less than a HS education reported smoking (52.4 and 59.3 %, respectively). Among those with a college degree, Asian adults had the lowest smoking prevalence (7.3 %), and AIAN adults the highest (20.5 %). Both white and black adults in the lowest income group had among the highest adjusted odds ratio of smoking (2.89, 95 % CI 2.70, 3.10, and 3.18, 95 % CI 2.43, 4.15, respectively). Higher odds were seen among white and AIAN adults lacking a high school education (aOR 4.02 and 3.80, respectively) (Table 3).

Obesity

The prevalence of obesity among adults with a disability was 37.1 %, ranging from 20.3 % (Asian) to 47.3 % (black). Black adults with a disability had the highest prevalence of obesity across all income groups except the highest level (\$75,000), in which AIAN adults had the highest prevalence (50.3 %). Across most income levels, Asian adults with a disability had the lowest prevalence of obesity. Across all education levels, black adults with disabilities had the highest prevalence of obesity and Asian adults the lowest. Significant associations between income and obesity were seen primarily for white adults, as all lower income groups had significantly greater odds for obesity than those in the highest income group, with odds ratios ranging from 1.14 to 1.23. For white, black, and Hispanic adults with a disability, similarly greater odds were seen for the three lower education levels when compared to those with the highest education level (college degrees; Table 4).

Discussion

The prevalence of disability by race/ethnicity varies dramatically, with approximately 1 in 10 Asian adults reporting a disability compared with nearly 1 in 3 AIAN adults. While our findings are consistent with previous research reporting differences between black and white adults [33], we also found a lower prevalence among black adults when compared with AIAN adults. Reasons behind the differences in disability prevalence could be due to a number of factors, including the variation in perception of disability by culture [39], or hesitation to self-report disability due to stigma [22, 26, 39]. Differing socioeconomic characteristics of adults in certain racial and ethnic groups may also affect disability prevalence [36], and poverty has been found to have more of an effect on disability among white women than among black women [43]. Although we found similar inverse patterns of disability by income and education, socioeconomic status may also act as a modifier to differences in disability prevalence among racial and ethnic groups [32].

While our findings of racial and ethnic disparities among adults with disabilities related to obesity and smoking are similar to those in the general population, we did observe some differences, particularly when taking SES into account. Prior research has found the prevalence of smoking to be similar between black and white adults when disability is unaccounted for [13]. Although smoking prevalence was similar among white, black, and NHPI adults in our study, white adults with a disability had a higher prevalence of smoking than did black adults in the lowest three income groups.

In general, income and education were both inversely associated with smoking among white, black, and Hispanic adults with a disability, consistent with the general population [17]. However, among AIAN adults, only an association between smoking and education was observed, as nearly 3 out of 5 AIAN adults with a disability with less than a high school education are current smokers. A higher prevalence of smoking among people with a disability [13], coupled with the increased prevalence among those with lowered income or education, suggests that disparities could be magnified for adults with disabilities. Understanding these disparities is particularly important, as poor health literacy, a risk factor for being unsuccessful at smoking cessation, is associated with lower education and income levels [41]. Smokers with lowered health literacy are more likely to report the positive effects of smoking, such as increased socialization, and less likely to report health risks [41]. This study suggests that conventional methods of education related to tobacco risks may be ineffective and recommend using other methods, such as pictures and plain language [41]. This health literacy barrier could also be compounded for people with cognitive related disabilities, where effectiveness of interventions that may not be accessible could be limited.

Further, understanding cultural views of tobacco use are important in addressing smoking cessation. For example, tobacco use may be linked to traditional ceremony and beliefs among some AIAN populations [23]. Our study found that lower education levels were strongly associated with smoking among AIAN adults with a disability. These findings, coupled with the previous research on health literacy, as well as cultural tobacco views, suggest that understanding social norms, views of smoking, and smoking-related disparities are key in developing appropriate interventions to address cessation.

Although income has been found to be associated with obesity in the general population [34], we saw an income association only among white adults with a disability. However, all lower education levels had similar associations with obesity compared with college graduates among white, black, and Hispanic adults with a disability. While the associations between education and obesity were similar for white, black, and Hispanic adults with a disability, differences in educational experiences by race and ethnicity have been suggested as factors in variation in obesity in the general population [20]. Though an inverse relationship between obesity and education has been documented in higher income countries, many studies do not account for other factors, including race and ethnicity, which may affect the findings [19]. We found when controlling for race and ethnicity that both income and education were inversely, but modestly, associated with obesity.

The SES disparities experienced by people with disabilities may mean that areas of obesity intervention (e.g., physical activity) may impose additional burdens for some people with disabilities. For example, someone with a low income may experience barriers to accessing physical activity venues which may include lack of access to public parks and trails, as well as availability of paid physical activities (e.g., gyms and fitness centers) [42]. Additionally, a person with a disability may encounter additional unique physical and emotional barriers to participation in physical activity, such as not being able to transfer to gym equipment if they use a wheelchair, having difficulty getting through doorways in gyms, not having information on accessible programs, or not being supported by family and friends to be more active [38]. Our findings show a higher prevalence of obesity among people with disabilities in lower income and education groups. Making safe and accessible options for interventions such as physical activity are crucial.

Limitations

There are limitations to our study, many of which are an extension of using survey data. The data are based on self-report, so they are subject to response and recall bias. The BRFSS is administered individually in each state and territory, so the results may not be nationally representative. Further, the BRFSS did not include cell phones in their sampling frame during 2007–2010. BRFSS disability variables do not measure severity, type, or permanence of disability or underlying medical condition that may associated with the disability. In addition, our disability estimates could be understated as BRFSS excludes those living in institutions or group homes. Even aggregating 4 years of data, there were many estimates with low sample size, particularly for NHPI respondents. Additionally, although Asians may exhibit health risks at lower BMI cutoffs relative to other race and ethnicity groups [30], this can vary by Asian subpopulations [30]. Since we did not have that level of detail, we did not alter our BMI cutoffs. Finally, although we assessed household income, we did not control for household size which might differ by race and ethnicity. Further, we only had information on range of household income and not specific income amounts.

Conclusion

To varying degrees, race/ethnicity and income and education are associated with increased health risks and behaviors among people with disabilities. While prior research shows that

health disparities exist among people with disabilities, this study presents evidence that disparities also exist among sociodemographic strata of adults with disabilities. We found additional disparities when we examined the association of race/ethnicity and SES with health indicators specific to people with disabilities. Understanding how race/ethnicity, income, and education vary in their associations with behavioral health risk factors among people with disabilities can prove helpful in allowing public health programs to focus their resources on segments of the disability population where needs may be greatest.

References

1. Ali MT, Hui X, Hashmi ZG, et al. Socioeconomic disparity in inpatient mortality after traumatic injury in adults. *Surgery*. 2013; 154:461–467. [PubMed: 23972652]
2. Anderson WL, Armour BS, Finkelstein EA, et al. Estimates of state-level health-care expenditures associated with disability. *Public health reports (Washington, D.C.: 1974)*. 2010; 125:44–51.
3. Armour BS, Campbell VA, Crews JE, et al. Peer reviewed: state-level prevalence of cigarette smoking and treatment advice, by disability status, United States, 2004. *Preventing Chronic Disease*. 2007; 4:A86. [PubMed: 17875261]
4. Armour BS, Courtney-Long EA, Campbell VA, et al. Disability prevalence among healthy weight, overweight, and obese adults. *Obesity (Silver Spring)*. 2013; 21:852–855. [PubMed: 23712989]
5. Bandini LG, Curtin C, Hamad C, et al. Prevalence of overweight in children with developmental disorders in the continuous national health and nutrition examination survey (NHANES) 1999–2002. *J Pediatr*. 2005; 146:738–743. [PubMed: 15973309]
6. Banks J, Marmot M, Oldfield Z, et al. Disease and disadvantage in the United States and in England. *JAMA*. 2006; 295:2037–2045. [PubMed: 16670412]
7. Barbeau EM, Krieger N, Soobader MJ. Working class matters: socioeconomic disadvantage, race/ethnicity, gender, and smoking in NHIS 2000. *Am J Public Health*. 2004; 94:269–278. [PubMed: 14759942]
8. MW Brault. *Americans With Disabilities: 2010*. Washington, DC: Department of Commerce (ed) U.S. CENSUS BUREAU; 2012.
9. Braveman PA, Cubbin C, Egerter S, et al. Socioeconomic disparities in health in the United States: what the patterns tell us. *Am J Public Health*. 2010; 100(Suppl 1):S186–S196. [PubMed: 20147693]
10. Centers for Disease Control and Prevention. [[Accessed 6/2/2015]] 2007–2010 Behavioral Risk Factor Surveillance System. <http://www.cdc.gov/brfss/index.html>
11. Centers for Disease Control and Prevention. CDC grand rounds: public health practices to include persons with disabilities. *MMWR Morb Mortal Wkly Rep*. 2013; 62:697–701. [PubMed: 23985498]
12. Centers for Disease Control and Prevention. CDC health disparities and inequalities report—United States, 2013. *MMWR Morb Mortal Wkly Rep*. 2013; 62:1–186. [PubMed: 23302815]
13. Centers for Disease Control and Prevention. Current cigarette smoking among adults—United States, 2011. *MMWR Morb Mortal Wkly Rep*. 2012; 61:889–894. [PubMed: 23134971]
14. Centers for Disease Control and Prevention. Differences in prevalence of obesity among black, white, and Hispanic adults—United States, 2006–2008. *MMWR Morb Mortal Wkly Rep*. 2009; 58:740–744. [PubMed: 19609247]
15. Centers for Disease Control and Prevention. [[Accessed 8/1/2014]] Social Determinants of Health. 2014. <http://www.cdc.gov/socialdeterminants/Definitions.html>
16. Centers for Disease Control and Prevention. Tobacco use among U.S. racial/ethnic minority groups—African Americans, American Indians and Alaska Natives, Asian Americans and Pacific Islanders, Hispanics. A Report of the Surgeon General. Executive summary. *MMWR Recomm Rep*. 1998; 47:v–xv. 1–16. [PubMed: 9784089]
17. Centers for Disease Control and Prevention. Vital signs: current cigarette smoking among adults aged ≥ 18 years—United States, 2009. *MMWR Morb Mortal Wkly Rep*. 2010; 59:1135–1140. [PubMed: 20829747]

18. Chando S, Tiro JA, Harris TR, et al. Effects of socioeconomic status and health care access on low levels of human papillomavirus vaccination among Spanish-speaking Hispanics in California. *Am J Public Health*. 2013; 103:270–272. [PubMed: 23237173]
19. Cohen AK, Rai M, Rehkopf DH, et al. Educational attainment and obesity: a systematic review. *Obes Rev*. 2013; 14:989–1005. [PubMed: 23889851]
20. Cohen AK, Rehkopf DH, Deardorff J, et al. Education and obesity at age 40 among American adults. *Soc Sci Med*. 2013; 78:34–41. [PubMed: 23246398]
21. Derrington TM, Kotelchuck M, Plummer K, et al. Racial/ethnic differences in hospital use and cost among a statewide population of children with Down syndrome. *Res Dev Disabil*. 2013; 34:3276–3287. [PubMed: 23892874]
22. Dionne CD, Gainforth HL, O'malley DA, et al. Examining implicit attitudes towards exercisers with a physical disability. *ScientificWorldJournal*. 2013; 2013:621596. [PubMed: 23710142]
23. Espey DK, Jim MA, Cobb N, et al. Leading causes of death and all-cause mortality in American Indians and Alaska Natives. *Am J Public Health*. 2014; 104(Suppl 3):S303–S311. [PubMed: 24754554]
24. Ewert T. Instrumentality of the International Classification of Functioning, Disability and Health (ICF) in classification of long-term consequences of diseases. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz*. 2012; 55:459–467. [PubMed: 22441515]
25. Froehlich-Grobe K, Lee J, Washburn RA. Disparities in obesity and related conditions among americans with disabilities. *Am J Prev Med*. 2013; 45:83–90. [PubMed: 23790992]
26. Green SE. “What do you mean ‘what’s wrong with her?’”: stigma and the lives of families of children with disabilities. *Soc Sci Med*. 2003; 57:1361–1374. [PubMed: 12927467]
27. Herd P, Goesling B, House JS. Socioeconomic position and health: the differential effects of education versus income on the onset versus progression of health problems. *J Health Soc Behav*. 2007; 48:223–238. [PubMed: 17982865]
28. Hosseinpoor AR, Stewart Williams JA, Gautam J, et al. Socioeconomic inequality in disability among adults: a multicountry study using the World Health Survey. *Am J Public Health*. 2013; 103:1278–1286. [PubMed: 23678901]
29. Iezzoni LI, Frakt AB, Pizer SD. Uninsured persons with disability confront substantial barriers to health care services. *Disabil Health J*. 2011; 4:238–244. [PubMed: 22014671]
30. Jih J, Mukherjea A, Vittinghoff E, et al. Using appropriate body mass index cut points for overweight and obesity among Asian Americans. *Prev Med*. 2014; 65:1–6. [PubMed: 24736092]
31. Karvonen-Gutierrez CA, Ylitalo KR. Prevalence and correlates of disability in a late middle-aged population of women. *J Aging Health*. 2013; 25:701–717. [PubMed: 23676712]
32. Mendes De Leon CF, Barnes LL, Bienias JL, et al. Racial disparities in disability: recent evidence from self-reported and performance-based disability measures in a population-based study of older adults. *J Gerontol B Psychol Sci Soc Sci*. 2005; 60:S263–S271. [PubMed: 16131627]
33. Nuru-Jeter AM, Thorpe RJ Jr, Fuller-Thomson E. Black-white differences in self-reported disability outcomes in the U.S.: early childhood to older adulthood. *Public health reports* (Washington, D.C.: 1974). 2011; 126:834–843.
34. Ogden CL, Lamb MM, Carroll MD, et al. Obesity and socioeco-nomic status in children and adolescents: United States, 2005–2008. *NCHS Data Brief*. 2010; 51:1–8. [PubMed: 21211166]
35. Ostchega Y, Harris TB, Hirsch R, et al. The prevalence of functional limitations and disability in older persons in the US: data from the National Health and Nutrition Examination Survey III. *J Am Geriatr Soc*. 2000; 48:1132–1135. [PubMed: 10983915]
36. Ozawa MN, Yeo YH. Race/ethnicity and socioeconomic class as correlates of disability in old age. *J Gerontol Soc Work*. 2008; 51:337–365.
37. Pappas G, Queen S, Hadden W, et al. The increasing disparity in mortality between socioeconomic groups in the United States, 1960 and 1986. *N Engl J Med*. 1993; 329:103–109. [PubMed: 8510686]
38. Rimmer JH, Riley B, Wang E, et al. Physical activity participation among persons with disabilities: barriers and facilitators. *Am J Prev Med*. 2004; 26:419–425. [PubMed: 15165658]

39. Scior K, Hamid A, Mahfoudhi A, et al. The relationship between awareness of intellectual disability, causal and intervention beliefs and social distance in Kuwait and the UK. *Res Dev Disabil.* 2013; 34:3896–3905. [PubMed: 24029806]
40. Sinclair LB, Fox MH, Betts DR. A tool for enhancing strategic health planning: a modeled use of the International Classification of Functioning, Disability and Health. *Int J Health Plann Manag.* 2013; 28:172–180.
41. Stewart DW, Adams CE, Cano MA, et al. Associations between health literacy and established predictors of smoking cessation. *Am J Public Health.* 2013; 103:e43–e49.
42. Taylor WC, Poston WSC, Jones L, et al. Environmental justice: obesity, physical activity, and healthy eating. *J Phys Act Health.* 2006; 3:S30.
43. Thorpe RJ Jr, Kasper JD, Szanton SL, et al. Relationship of race and poverty to lower extremity function and decline: findings from the Women's Health and Aging Study. *Soc Sci Med.* 2008; 66:811–821. [PubMed: 18164113]
44. Thorpe RJ Jr, Szanton SL, Bell CN, et al. Education, income and disability in African Americans. *Ethn Dis.* 2013; 23:12–17. [PubMed: 23495616]
45. Warner DF, Brown TH. Understanding how race/ethnicity and gender define age-trajectories of disability: an intersectionality approach. *Soc Sci Med.* 2011; 72:1236–1248. [PubMed: 21470737]
46. Weinick RM, Zuvekas SH, Cohen JW. Racial and ethnic differences in access to and use of health care services, 1977 to 1996. *Med Care Res Rev.* 2000; 57(Suppl 1):36–54. [PubMed: 11092157]
47. Whitaker RC, Orzol SM. Obesity among US urban preschool children: relationships to race, ethnicity, and socioeconomic status. *Arch Pediatr Adolesc Med.* 2006; 160:578–584. [PubMed: 16754818]
48. Zheng H, George LK. Rising U.S. income inequality and the changing gradient of socioeconomic status on physical functioning and activity limitations, 1984–2007. *Soc Sci Med.* 2012; 75:2170–2182. [PubMed: 22959768]

Table 1

Sample characteristics of adults 18 years of age or older with disabilities, 2007–2010 Behavioral Risk Factor Surveillance System

Demographic category	% ^a (95 % CI)	Weighed population estimate
Sex		
Male	47.2 (46.8, 47.6)	22,587,321
Female	52.8 (52.4, 53.2)	26,727,658
Race and ethnicity		
White/non-Hispanic	73.0 (72.6, 73.4)	35,667,702
Black/non-Hispanic	11.0 (10.7, 11.3)	4,994,316
Hispanic	12.5 (12.1, 12.9)	5,096,483
Asian	1.5 (1.4, 1.7)	649,607
NHPI	0.3 (0.3, 0.4)	113,948
AIAN	1.7 (1.6, 1.8)	758,618
Age group		
18–44	29.8 (29.4, 30.1)	14,680,582
45–64	41.0 (40.8, 41.3)	20,238,717
65+	29.2 (29.0, 29.4)	14,395,681
Income		
<\$20,000	29.4 (29.0, 29.8)	12,554,853
\$20,000–<\$35,000	22.7 (22.4, 23.1)	9,993,713
\$35,000–<\$50,000	13.7 (13.4, 14.0)	5,885,676
\$50,000–<\$75,000	13.4 (13.1, 13.7)	5,663,324
\$75,000+	20.9 (20.5, 21.3)	8,560,387
Education		
<High school	14.0 (13.7, 14.4)	7,033,436
High school/GED	30.9 (30.5, 31.3)	15,235,615
Some college	29.1 (28.7, 29.5)	13,878,349
College graduate	26.0 (25.7, 26.4)	13,039,833
Employment		
Employed	40.6 (40.2, 41.0)	16,921,531
Unemployed	10.2 (9.9, 10.4)	3,951,819
Retired/student/homemaker	28.3 (28.0, 28.6)	17,922,162
Unable to work	20.9 (20.6, 21.2)	10,313,354
Smoking status		
Current smoker	27.7 (27.3, 28.1)	11,666,549
Former smoker	26.4 (26.1, 26.8)	15,468,576
Never smoker	45.9 (45.5, 46.3)	21,890,764
Body mass index		
Normal/underweight	30.9 (30.5, 31.3)	13,991,365
Overweight	32.0 (31.6, 32.4)	15,726,194
Obese	37.1 (36.7, 37.5)	17,662,158

Total weighted population estimate for each demographic category may not equal the totals for other categories due to exclusion of missing responses for those variables

CI confidence interval, *NHPI* Native Hawaiian or Pacific Islander, *AIAN* American Indian or Alaska Native, *GED* General Educational Development

^aWeighted and age adjusted to the 2000 US standard population (age estimates not age adjusted)

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 2

Prevalence of disability by race and ethnicity among adults 18 years of age or older, 2007–2010 Behavioral Risk Factor Surveillance System

	White/non-Hispanic % (95 % CI)	Black/non-Hispanic % (95 % CI)	Hispanic % (95 % CI)	Asian % (95 % CI)	NHPI % (95 % CI)	AIAN % (95 % CI)	Total % (95 % CI)
Total	21.5(21.4,21.7)	22.7(22.3, 23.2)	17.7(17.3, 18.1)	10.1(9.5, 10.9)	17.9(15.5,20.7)	31.0(29.8,32.3)	21.0(20.9,21.1)
Sex							
Male	20.8(20.6,21.0)	21.4(20.7,22.1)	16.9(16.3, 17.6)	10.2(9.2, 11.2)	16.4(13.3, 20.2)	28.7(26.8, 30.6)	20.2(20.0, 20.4)
Female	22.2(22.0, 22.3)	23.7(23.3, 24.2)	18.3(17.8, 18.8)	10.1(9.2, 11.0)	19.4(15.9, 23.5)	33.7(32.0, 35.3)	21.7(21.5,21.8)
Age group							
18–44	14.0(13.8, 14.2)	13.4(12.9, 14.0)	10.0(9.5, 10.5)	5.7(5.0,6.5)	10.9(8.4, 14.1)	18.9(17.2,20.8)	13.0(12.8, 13.2)
45–64	26.1(25.9, 26.3)	30.2(29.5,31.0)	22.8(22.1,23.6)	10.9(9.8, 12.2)	20.5(16.2,25.5)	44.6(42.5, 46.8)	26.2(26.0, 26.4)
65+	37.0(36.7, 37.2)	38.7(37.7, 39.7)	32.8(31.5,34.1)	22.6(20.0, 25.3)	35.2(26.4, 45.3)	45.0(41.9,48.1)	36.7(36.5, 37.0)
Income							
<\$20,000	43.4(42.9, 44.0)	35.7(34.8, 36.7)	23.1(22.4,23.9)	15.4(13.1,18.0)	36.3(28.8, 44.6)	45.4(42.8, 48.0)	35.1(34.7,35.5)
\$20,000–\$35,000	27.5(27.1,27.9)	22.1(21.2,22.9)	15.4(14.6, 16.2)	12.0(10.2,14.2)	19.2(14.5,25.0)	31.5(28.8,34.3)	24.1(23.8,24.4)
\$35,000–\$50,000	20.9(20.6,21.3)	17.0(16.0, 18.1)	14.3(13.1, 15.7)	8.3(6.8, 10.2)	16.3(10.5,24.6)	24.1(20.9,27.5)	19.6(19.3,19.9)
\$50,000–\$75,000	17.7(17.4, 18.0)	14.7(13.7, 15.8)	14.5(13.1, 16.0)	9.5(7.9,11.5)	12.2(7.7, 18.7)	21.0(17.8,24.7)	17.2(16.9, 17.4)
\$75,000+	14.6(14.4, 14.8)	12.5(11.5, 13.5)	11.2(10.2, 12.3)	8.0(6.9, 9.2)	8.4(5.8, 12.0)	22.4(18.8, 26.5)	14.2(14.0,14.4)
Education							
<High school	35.2(34.5, 35.9)	32.8(31.5,34.2)	18.2(17.5, 18.9)	13.4(10.4, 17.1)	22.7(15.9,31.3)	38.1(34.9,41.4)	27.1(26.6,27.5)
High school/GED	23.4(23.1, 23.7)	23.4(22.6, 24.1)	17.9(17.1,18.7)	11.5(9.8,13.5)	21.2(16.6,26.8)	28.9(26.9,31.0)	22.5(22.2, 22.7)
Some college	23.2(22.9, 23.5)	23.1(22.3, 23.9)	19.3(18.4, 20.3)	11.8(10.1, 13.6)	19.6(15.1,24.9)	32.5(30.0, 35.1)	22.9(22.6,23.1)
College graduate	17.1(16.9, 17.3)	16.1(15.4, 16.9)	14.6(13.8, 15.4)	8.8(8.0, 9.7)	12.9(9.3, 17.7)	27.4(24.7, 30.4)	16.6(16.4, 16.8)
Employment							
Employed	14.6(14.4, 14.7)	11.8(11.3, 12.4)	9.9(9.4, 10.5)	6.7(5.9, 7.6)	9.7(7.0, 13.2)	17.5(15.9, 19.2)	13.6(13.5, 13.8)
Unemployed	30.4(29.6,31.1)	22.3(20.9, 23.9)	19.3(17.3,21.4)	15.2(11.6, 19.7)	21.1(13.8,30.8)	32.2(27.4, 37.5)	26.6(26.0, 27.2)
Retired/student/homemaker	22.1(21.8,22.5)	22.6(21.7,23.6)	16.8(16.1, 17.5)	10.2(9.0, 11.6)	18.6(14.7,23.3)	30.2(27.4, 33.1)	21.1(20.9,21.4)
Unable to work	87.4(86.7, 88.1)	73.5(71.5,75.3)	70.8(68.1,73.3)	66.7(56.1,75.8)	70.4(55.4, 82.0)	83.2(78.5, 87.0)	81.7(80.9,82.4)

Prevalence was weighted and age adjusted to the 2000 US standard population (age estimates not age adjusted)

NHPI/Native Hawaiian or Pacific Islander, AIAN/American Indian or Alaska Native, CI confidence interval, GED/General Educational Development

Table 3

Prevalence and adjusted odds ratios for smoking among adults 18 years of age or older with a disability, stratified by race and ethnicity, 2007–2010
Behavioral Risk Factor Surveillance System

	White/Non-Hispanic			Black/non-Hispanic			Hispanic			Asian			NHPI			AIAN			Total		
	% (95 % CI)	aOR (95 % CI)	% (95 % CI)	aOR (95 % CI)	% (95 % CI)	aOR (95 % CI)	% (95 % CI)	aOR (95 % CI)	% (95 % CI)	aOR (95 % CI)	% (95 % CI)	aOR (95 % CI)	% (95 % CI)	aOR (95 % CI)	% (95 % CI)	aOR (95 % CI)	% (95 % CI)	aOR (95 % CI)	% (95 % CI)	aOR (95 % CI)	% (95 % CI)
Total	28.7 (28.3, 29.2)		28.1 (26.9, 29.3)		20.6 (19.3, 21.9)		12.8 (10.1, 16.2)		28.2 (21.9, 35.6)		41.2 (38.3, 44.1)		27.7 (27.3, 28.1)								
Income																					
<\$20,000	45.0 (44.0, 46.0)	2.89 (2.70, 3.10)	35.0 (33.1, 37.0)	3.18 (2.43, 4.15)	23.6 (21.5, 25.9)	1.93 (1.41, 2.66)	19.8 (12.6, 29.7)	2.57 (1.11, 5.95)	41.0 (27.7, 55.8)	4.16 (1.23, 14.06)	47.3 (43.1, 51.6)	1.57 (0.97, 2.56)	38.8 (38.0, 39.7)								
\$20,000–<\$35,000	35.9 (34.8, 36.9)	2.23 (2.08, 2.38)	28.7 (26.3, 31.2)	2.58 (1.98, 3.36)	20.1 (17.5, 22.9)	1.66 (1.20, 2.29)	16.1 (9.1, 26.7)	1.84 (0.72, 4.70)	23.2 (14.0, 35.9)	2.20 (0.63, 7.66)	39.9 (33.8, 46.3)	1.28 (0.77, 2.11)	32.3 (31.4, 33.2)								
\$35,000–<\$50,000	27.7 (26.6, 29.0)	1.72 (1.60, 1.85)	22.0 (18.7, 25.6)	2.07 (1.55, 2.78)	19.6 (15.5, 24.4)	1.67 (1.12, 2.49)	18.4 ^a (9.1, 33.7)	3.62 (1.22, 10.72)	33.3 ^a (16.5, 55.8)	4.85 (1.14, 20.63)	38.3 (29.4, 48.0)	1.50 (0.85, 2.63)	26.4 (25.2, 27.5)								
\$50,000–<\$75,000	20.8 (19.8, 21.8)	1.39 (1.29, 1.49)	17.7 (14.9, 21.0)	1.70 (1.26, 2.30)	19.1 (14.7, 24.5)	1.66 (1.10, 2.50)	11.2 (6.8, 17.8)	2.16 (0.85, 5.47)	15.1 ^a (6.0, 33.0)	1.88 (0.39, 9.13)	36.0 (25.3, 48.1)	1.19 (0.69, 2.05)	20.3 (19.4, 21.3)								
\$75,000+	14.0 (13.3, 14.8)	Ref	11.1 (8.9, 13.7)	Ref	11.2 (8.8, 14.3)	Ref	5.4 (3.2, 9.1)	Ref	9.6 ^a (4.5, 19.2)	Ref	23.7 (17.1, 31.8)	Ref	13.7 (13.1, 14.4)								
Education																					
<High school	52.4 (51.0, 53.8)	4.02 (3.75, 4.31)	41.0 (37.7, 44.2)	2.20 (1.80, 2.69)	23.7 (21.1, 26.5)	1.53 (1.16, 2.01)	32.2 (18.0, 50.6)	2.57 (1.04, 6.37)	28.7 (15.3, 47.4)	2.37 (0.74, 7.59)	59.3 (53.7, 64.7)	3.80 (2.55, 5.66)	42.8 (41.6, 44.1)								
High school/GED	36.6 (35.8, 37.5)	2.55 (2.42, 2.70)	31.5 (29.3, 33.7)	1.79 (1.50, 2.15)	21.9 (19.6, 24.3)	1.55 (1.19, 2.03)	20.1 (12.8, 30.1)	2.03 (0.94, 4.39)	38.5 (26.8, 51.8)	4.41 (1.61, 12.07)	43.4 (38.6, 48.3)	2.31 (1.60, 3.33)	34.0 (33.3, 34.8)								
Some college	28.4 (27.6, 29.1)	2.06 (1.95, 2.17)	25.7 (23.8, 27.7)	1.68 (1.41, 2.01)	20.4 (17.9, 23.1)	1.56 (1.19, 2.04)	18.2 (11.6, 27.4)	2.00 (0.92, 4.36)	25.7 (16.5, 37.6)	1.83 (0.62, 5.40)	37.6 (32.4, 43.2)	1.82 (1.27, 2.59)	27.4 (26.7, 28.1)								
College graduate	12.5 (11.9, 13.1)	Ref	13.5 (11.8, 15.3)	Ref	13.4 (11.2, 16.0)	Ref	7.3 (4.7, 11.3)	Ref	17.6 ^a (9.0, 31.6)	Ref	20.5 (15.4, 26.7)	Ref	12.7 (12.2, 13.3)								

Prevalence was weighted and age adjusted to the 2000 US standard population. Odds ratios were adjusted for age, sex, income, education, employment status

NHPI/Native Hawaiian or Pacific Islander, AIAN American Indian or Alaska Native, CI confidence interval, GED General Educational Development

^aEstimate has a relative standard error (RSE) of 30 % and should be interpreted with caution

Table 4

Prevalence and adjusted odds ratios for obesity among adults 18 years of age or older with a disability, stratified by race and ethnicity, 2007–2010
Behavioral Risk Factor Surveillance System

	White/non-Hispanic			Black/Non-Hispanic			Hispanic			Asian			NHPI			AIAN			Total	
	% (95 % CI)	aOR (95 % CI)	% (95 % CI)	aOR (95 % CI)	% (95 % CI)	aOR (95 % CI)	% (95 % CI)	aOR (95 % CI)	% (95 % CI)	aOR (95 % CI)	% (95 % CI)	aOR (95 % CI)	% (95 % CI)	aOR (95 % CI)	% (95 % CI)	aOR (95 % CI)	% (95 % CI)	aOR (95 % CI)	% (95 % CI)	
Total	35.5 (35.1,36.0)		47.3 (46.0, 48.6)		39.9 (38.3,41.4)		20.3 (17.0,24.1)		31.8 (25.0, 39.5)		40.6 (37.6, 43.6)		37.1 (36.7, 37.5)							
Income																				
<\$20,000	38.4 (37.5, 39.4)	1.14 (1.08, 1.20)	47.5 (45.5, 49.5)	0.84 (0.68, 1.05)	41.7 (39.3, 44.2)	0.90 (0.71, 1.14)	29.3 (20.1,40.5)	1.62 (0.76, 3.48)	33.3 (21.8,47.1)	1.13 (0.34, 3.77)	38.2 (34.2, 42.3)	0.65 (0.42, 1.01)	40.4 (39.5,41.2)							
\$20,000—<\$35,000	38.7 (37.7, 39.8)	1.21 (1.16, 1.27)	45.7 (42.9, 48.4)	0.81 (0.65, 1.00)	37.0 (33.9, 40.2)	0.80 (0.63, 1.02)	17.2 (10.9, 25.9)	1.08 (0.53, 2.24)	42.2 (29.1,56.4)	1.79 (0.64, 5.01)	40.7 (34.6, 47.0)	0.68 (0.43, 1.07)	39.0 (38.1,39.9)							
\$35,000—<\$50,000	36.7 (35.5, 37.9)	1.20 (1.15, 1.26)	51.5 (47.3, 55.6)	1.08 (0.86, 1.37)	37.8 (32.8, 43.1)	0.87 (0.65, 1.17)	28.2 (18.1,41.1)	1.76 (0.84, 3.68)	26.3 ^a (12.9, 46.3)	1.14 (0.27, 4.86)	40.8 (32.2, 49.9)	0.69 (0.42, 1.14)	38.3 (37.1, 39.5)							
\$50,000—<\$75,000	37.3 (36.2, 38.5)	1.23 (1.17, 1.30)	52.2 (47.7, 56.8)	1.22 (0.96, 1.56)	42.9 (36.8, 49.3)	1.12 (0.82,1.54)	14.0 (8.7,21.8)	0.71 (0.38, 1.33)	14.8 ^a (7.0, 28.5)	0.46 (0.10, 2.08)	38.9 (29.8, 48.8)	0.72 (0.44, 1.18)	38.4 (37.2, 39.6)							
\$75,000+	31.2 (30.3, 32.1)	Ref	48.7 (44.1, 53.5)	Ref	38.1 (33.5, 42.9)	Ref	17.8 (13.1,23.7)	Ref	22.9 (12.5,38.1)	Ref	50.3 (38.7,61.8)	Ref	32.1 (31.3,33.0)							
Education																				
<High school	36.6 (35.2, 37.9)	1.31 (1.24, 1.39)	45.3 (42.2, 48.4)	1.36 (1.15, 1.61)	41.9 (39.0, 44.9)	1.37 (1.12, 1.67)	17.9 ^a (8.7, 33.4)	0.86 (0.32, 2.26)	32.6 (18.7, 50.4)	2.80 (0.73, 10.71)	35.3 (29.3,41.9)	1.06 (0.75, 1.51)	38.8 (37.7, 40.0)							
High school/GED	37.8 (37.0, 38.6)	1.35 (1.29, 1.40)	47.1 (44.8, 49.4)	1.36 (1.17, 1.58)	39.3 (36.3, 42.4)	1.29 (1.05, 1.58)	23.3 (15.7, 33.0)	1.03 (0.55, 1.92)	32.9 (23.1,44.4)	1.77 (0.53, 5.91)	41.3 (36.5, 46.2)	1.31 (0.94, 1.81)	39.0 (38.2, 39.7)							
Some college	38.0 (37.2, 38.8)	1.36 (1.31, 1.41)	50.3 (48.0, 52.7)	1.41 (1.22, 1.64)	40.6 (37.6, 43.6)	1.28 (1.06,1.55)	26.0 (18.8, 34.8)	1.67 (0.98, 2.83)	36.7 (25.3, 49.7)	2.08 (0.68, 6.35)	43.5 (37.9, 49.3)	1.45 (1.05,2.02)	39.5 (38.8, 40.2)							
College graduate	30.2 (29.5,31.0)	Ref	43.6 (40.4, 46.8)	Ref	34.8 (31.7,38.1)	Ref	17.7 (13.5, 22.9)	Ref	22.5 ^a (10.4,42.1)	Ref	40.8 (33.3, 48.9)	Ref	31.3 (30.6, 32.1)							

Prevalence was weighted and age adjusted to the 2000 US standard population. Odds ratios were adjusted for age, sex, income, education, and employment status

NHPI/Native Hawaiian or Pacific Islander, AIAN American Indian or Alaska Native, CI confidence interval, GED General Educational Development

^aEstimate has a relative standard error (RSE) of 30% and should be interpreted with caution